NATIONAL CHILD SURVIVAL AND SAFE MOTHERHOOD PROGRAMME

SURVEILLANCE

MCH DIVISION
Ministry of Health and Family Welfare
Government of India
New Delhi

NATIONAL HEALTH POLICY MCH GOALS

	Current Level 2000	
A. REDUCTION OF MORTALITY RATES (/1000)		
Infant Mortality Rate (1992)	79	< 60
Perinatal Mortality Rate (1991)	46	< 35
Under 5 Mortality Rate (1991)	26.5	< 10
Maternal Mortality Rate (Est. 1992)	4	< 2
B. REDUCTION IN THE PROPORTION OF LBW (%)		
Under Weight Babies (Est. 1992)	30	10
C. SERVICES (% COVERAGE)		
Immunization - Infants (1992-93)	87.6	85
- Pregnant Women	81.6	100
Deliveries by trained personals (91)	46.3	100
Antenatal care (Est. 1992)	79	100
D. PREVENTION OF BLINDNESS DUE TO VIT. A DEFICIENCY		
Blindness Control (%)		0.3

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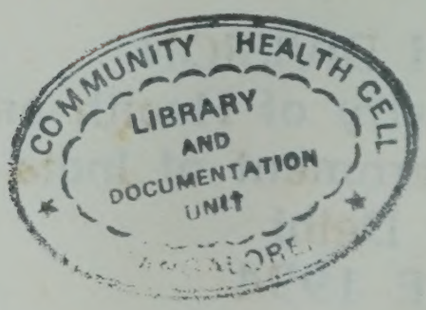

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PREFACE

The goals for the reduction of maternal, perinatal, infant and child mortality rates have been laid down in the National Health Policy (1983). As a result of sustained high levels of immunization coverage and the frequent contacts established under the programme with women and children, significant declining trends in neonatal, infant and child mortality rates were recorded during the period 1984 to 1992. Nearly 17 lakh children under five years of age were saved in 1992 alone if the difference in the child mortality rate in 1992 is compared with the rates in 1984, the year prior to the launching of the Universal Immunization Programme.

Under the Child Survival and Safe Motherhood Programme, the declining trends of morbidity and mortality rates are expected to be accelerated by expanding the quality and reach of maternal and child health services. Other goals to be achieved are eradication of poliomyelitis by the end of the decade, the elimination of neonatal tetanus and 95% reduction in the mortality due to measles by 1995.

An effective surveillance system is essential to achieve the above goals as reliable epidemiological data are necessary for effective planning, monitoring the quality of the services and documentation of impact. The manual details the essential steps for establishing the surveillance system for collection and analysis of data and lists recommendations for area and problem-specific follow-up action to be taken at the field level.

I. THE SURVEILLANCE SYSTEM

1. INTRODUCTION

The Child Survival and Safe Motherhood (CSSM) Programme was started in August 1992 with the objective of improving the health status of women and children and reducing maternal, infant and child mortality rates. The Programme addresses the major causes of morbidity and mortality in women and children which are preventable by readily available cost-effective interventions.

The goals expected to be achieved are:

- **By 1995**
  - Elimination of neonatal tetanus
  - Reduction in measles incidence by 90% and mortality by 95%
- **By 2000**
  - Eradication of poliomyelitis
  - Reduction in mortality due to diarrhoea by 70%
  - Reduction in ARI mortality by 40%
  - Reduction of maternal mortality to 2 per 1000 deliveries
  - Reduction of perinatal mortality to 35 per 1000 births
  - Reduction of infant mortality to 60 or less per 1000 live births
  - Reduction of under 5 child mortality to 10 per 1000 children under 5 years of age

2. WHAT IS SURVEILLANCE?

Surveillance is the regular collection and use of data on:

- The number of cases and deaths due to the diseases covered under the CSSM Programme
- Age-groups and geographical areas affected
- Type and rates of complications following the above illnesses
- Case fatality rates, and
- Impact of services.

3. WHY IS SURVEILLANCE IMPORTANT?

Surveillance is important for a number of reasons. Surveillance data are required for:

- Highlighting the magnitude of the illness as a public health problem.
  - Large number of children or women affected
  - High mortality rates
  - Cause of lifelong debilitating sequelae

- Providing epidemiological data for planning programme interventions.
  - Which are the age-groups most affected
  - Are there seasonal variations
  - Are there cyclic trends
  - Are some groups of the community more vulnerable
  - Are there risk factors that affect complications and mortality rates

- Monitoring the quality of the services
  - Is the programme having the expected impact on the incidence and mortality rates
  - Are the trends commensurate with services provided
  - Immunization status of cases
  - ORT use rate of cases prior to admission in hospital
  - Referral of cases of severe pneumonia
  - Referral of maternal complications

- Identifying high risk pockets for additional action
  - Is the programme having less than the desired impact in some pockets
  - Are the reported incidence and mortality rates higher in selected pockets
  - Is the reported incidence of severe adverse events higher in selected pockets

- Identifying outbreaks early
  - Prevent spread of the outbreak to other vulnerable pockets
  - Early and appropriate treatment to prevent deaths

- Estimating programme needs for drugs
  - Cotrimoxazole tablets or parenteral antibiotics required for treatment of pneumonia in children
  - Number of ORS packets required
  - Quantities of EOC drugs required, etc.

- Achieving goals of polio eradication and neonatal tetanus elimination.
  - Strategies for achieving the above goals require reliable surveillance data
- Documenting impact of services
  - Declining trends of diseases
  - Number of cases and deaths prevented
  - Number of lifelong disabling complications prevented
  - Reduction in maternal, perinatal, neonatal, infant and child mortality rates

4. PURPOSE OF TRAINING

The surveillance system is most effective if the data are analyzed and used at the level at which the data are collected. The purpose of the training is to:

- Provide the knowledge and skills to establish a reliable surveillance system at the PHC and district levels.
- Compile epidemiological data at PHC and district levels.
- Utilize surveillance data for improving the effectiveness of the MCH services.
- Develop a surveillance system to meet the needs of neonatal tetanus elimination and polio eradication strategies.
- Identify outbreaks in time for early preventive measures.
- Establish a surveillance system for severe adverse events following immunization.
- Establish a surveillance system to document impact of services.

II. COLLECTION OF DATA

1. DATA TO BE COLLECTED

1.1 The minimum information that must be collected at all levels of the health care system is the number of cases and deaths. This information must be collected for each disease separately. At the subcentre, PHC and district levels, monthwise information must be available on number of cases and deaths due to:

- ☐ VACCINE PREVENTABLE DISEASES
  - o Diphtheria
  - o Pertussis
  - o Neonatal tetanus
  - o Tetanus {others}
  - o Poliomyelitis
  - o Measles, and
  - o Childhood tuberculosis

- ☐ DIARRHOEAL DISEASES
  - o Acute watery diarrhoea
  - o Dysentery
  - o Persistent diarrhoea
  - o Cholera

- ☐ ARI
  - o Pneumonia

- ☐ VITAMIN A DEFICIENCY
  - o Night-blindness

- ☐ MATERNAL DEATHS
  - o Antenatal (before delivery)
  - o Intra-natal (during delivery)
  - o Post-natal (within 6 weeks of delivery)

1.2 Data must also be collected on the mortality (number of deaths) in different age groups:

- ☐ Under one month of age (neonatal)
- ☐ Under one year of age (infant)
- ☐ Under 5 years of age (child)

1.3 Besides collection of data on diseases, information must also be collected on severe adverse reactions following immunization.

1.4 Data on outbreaks are collected and analyzed separately. Investigation of outbreaks is useful in identifying factors that led to the outbreaks and evaluating efficacy of the control measures. Such investigations provide useful experience for undertaking appropriate action in future.

1.5 For some diseases which are relatively rare and diseases which are planned to be eradicated or eliminated, detailed information on each reported case is essential. Diseases for which detailed information must be collected are poliomyelitis, neonatal tetanus, measles (if measles immunization coverage levels are above 85%), severe diarrhoea-associated dehydration in children under 5 years, diarrhoea-associated death and maternal deaths.

For diseases which are still widespread and collection and compilation of information of all cases is not physically possible (such as measles if coverage levels are less than 85%; all cases of diarrhoea or pneumonia) such information may be collected selectively to obtain local epidemiological data on age-groups, geographical areas affected and efficacy of the programme interventions.

The information should be listed in a register (**LINE LIST**) and contain the following information:

- ☐ Name
- ☐ Name of father or mother
- ☐ Age
- ☐ Sex
- ☐ Date of onset of symptoms
- ☐ Date of examination
- ☐ Date of reporting
- ☐ Immunization status
- ☐ FULL Address
- ☐ Diagnosis
- ☐ Outcome
- ☐ Laboratory investigations (if conducted)
- ☐ Follow-up action taken
- ☐ Hospital/health centre
- ☐ Hospital registration number

Line listing is necessary to check for duplications in reported cases, assess immunization status, spot map areas of high risk and to make decisions on follow-up action to be taken (this will depend on the period between onset of symptoms and the receipt of the report). Follow-up visits are often necessary to confirm diagnosis, especially of poliomyelitis. Full address is necessary to trace children.

2. QUALITY OF DATA

2.1 The quality of data collected depends on many factors such as regularity of the reports, timeliness with which these are received, completeness of data submitted and diagnostic criteria. If these factors are not checked and corrected, they can often lead to fallacious conclusions and ineffective use of surveillance data.

Regularity of Reports

Surveillance data are generally submitted once in a month. All reporting sites (hospitals, health centres, subcentres and others which have been designated as reporting sites) must submit monthly reports. If no cases are seen, a 'nil' report should be submitted. At the PHC and district levels, the receipt of the reports should be monitored. A single missing report from a large hospital or during the seasonal peak can artificially reduce the number of cases and deaths reported from an area.

Timeliness of the Reports

Reports should be received within a reasonable period of time. The effectiveness of follow-up action depends on the promptness with which these are undertaken. A date should be fixed at each level for receiving the monthly reports.

Cases of poliomyelitis and neonatal tetanus must be notified immediately to the local medical officer.

A cluster of cases, sudden increase in cases or even a single case from a tribal area, or other vulnerable pockets with higher mortality rates and inadequate health care, should be notified immediately.

Reporting Site	J	F	M	A	M	J	J	A	S	O	N	D
Hospital A												
Hospital B...												
CHC A												
CHC B...												
PHC A												
PHC B												
PHC C												
...												
Total												

Completeness of the Reports

Reports must be complete in all respects and all the columns in the surveillance report must be filled. If no cases are seen '0' or 'nil' should be entered. If some figures need to be rechecked or confirmed, a note to that affect may be mentioned and a supplementary report sent subsequently.

Diagnostic Criteria

Uniform criteria of diagnosis is important for diseases which have a wide spectrum of clinical presentation and there are other clinical conditions similar to the diseases being reported. Uniform criteria are also important as in our country the cases are likely to be seen by physicians and health workers with varied clinical background and experience. Standard case definitions have been prepared and circulated and you may already be familiar with them. These have also been discussed in the concerned manuals on programme interventions. The standard case definitions have also been included in the annexures of this manual for ready reference. Be sure that all the reporting sites in your area know and use these case definitions.

For some of the diseases which can be easily recognized and for which treatment schedules are safe and effective, case definitions have been simplified so that the peripheral health staff can recognize and treat cases or refer them to you. These include diarrhoeal diseases, pneumonia in young children, night-blindness and anaemia in pregnant women. The health staff should also be able to recognize and report cases of vaccine preventable diseases. They should also be able to recognize common maternal complications.

It is important that the community should also be aware of the danger signs so that the children can receive early and appropriate treatment. Failure to recognize these signs can cost the child her or his life.

3. SOURCES OF DATA COLLECTION

3.1 Hospitals

Hospitals are a rich source of epidemiological data. Hospitals usually see a large proportion of the total cases. Since such hospitals have experienced physicians, the quality of diagnosis is relatively good. Hospitals normally maintain detailed case records and can provide line lists of cases.

Data from the hospitals can be used to study disease trends in the area, immunization status, ORT use rate, sex ratio and age-groups. Information from the hospitals can be used spot-mapping of cases by residential areas for the identification of high risk pockets. Hospitals can also provide an early warning of an outbreak if the number of cases suddenly increase.

Data from large hospitals is often analyzed separately. Such hospitals are called sentinel sites or sentinel hospitals.

3.2 Health Centres

Information from the large hospitals must be supplemented by data from smaller hospitals and other health facilities to improve the completeness of reporting. The more number of reporting sites the more likely that fewer cases will be missed from the surveillance reports.

It is important that all primary health centres and community health centres are involved in the surveillance system so that cases of poliomyelitis or neonatal tetanus are not missed and completeness of reporting of other diseases is improved. Moreover, follow-up action in the field will be taken at these levels.

3.3 Peripheral Health Staff

The peripheral health staff should be alerted to report cases of poliomyelitis and neonatal tetanus so that no cases are missed, especially cases who did not report for treatment or reported too late. Many cases of neonatal tetanus die at home without seeking medical care and information which is limited only to the hospitals and health centres may lead to gross under-estimation of incidence.

The health personnel must report a sudden increase in cases or a death due to a vaccine preventable disease or diarrhoea so that possible outbreaks could be identified early. This is particularly important if the outbreak is localized and as such early warning signs may be not be received from other sources such as the hospitals.

The peripheral health staff have regular and close contact with the community, especially in the rural areas and can easily obtain information from key informers in the villages on maternal, infant and child deaths in their areas. Information can also be collected by them on cases of vaccine preventable diseases, night-blindness, diarrhoea and pneumonia.

Information collected through the peripheral health staff is called **ACTIVE SURVEILLANCE** as additional efforts are made to seek information on cases and deaths in contrast to **PASSIVE SURVEILLANCE** which relies on information of cases which seek medical treatment in hospitals and other health facilities.

3.4 Private Practitioners

Usually information collected from hospitals, health centres and the paramedical personnel is adequate for programme purposes. Although, the private practitioners treat a large number of cases of diarrhoea and ARI in children, it is operationally not feasible to collect surveillance data from the several thousand private practitioners in the country. Moreover, such information would provide little additional benefit if the surveillance from other sources is satisfactory.

Private practitioners should, however, be approached to report cases of poliomyelitis and other cases of acute flaccid paralysis in children since the objective is not to miss even a single case. Their help should be sought for ensuring **COMPLETE AND TIMELY** reporting of cases of poliomyelitis.

Private practitioners can also help in the early identification of outbreaks if a sudden increase in cases is seen. This would be particularly helpful if outbreaks are localized. Such outbreaks may not affect hospital data and early warning signs may be limited.

3.5 Specialized Departments such as Rehabilitation Centres, Ophthalmic Departments

Usually information collected from hospitals, health centres and the paramedical personnel is adequate for programme purposes. However, for achieving the goal of polio eradication it is important that **NO CASE IS MISSED** and selected departments such as rehabilitation centres and physio-therapy units can be an additional source of information on poliomyelitis. Since such cases are likely to have had onset prior to the year of reporting, line lists should be obtained with the month and year of the onset of paralysis.

Similarly, ophthalmic departments can provide information on the presence or absence of cases with overt ocular signs of vitamin A deficiency seeking treatment in these departments.

3.6 Disease Surveys

Disease surveys are not done as a routine. These are expensive and time consuming. Methodologies and questionnaires must be well designed. Sample size required to obtain statistically valid rates or impact documentation is very large. The lower the incidence rate, the larger the sample size required. The decision to organize a disease survey is not expected to be taken at the PHC or district level. Disease surveys will not be discussed further in this manual.

The results of large scale disease surveys conducted in 1981-82 to collect baseline data on poliomyelitis and neonatal tetanus are given in the annexure for information.

As an alternative to disease surveys, an active search through key informers for lame children and neonatal deaths can be made in the **high risk pockets**. If no children with residual polio paralysis with onset of paralysis during the year(s) under reference or neonatal tetanus deaths are found in these pockets it will further confirm the absence of disease in the PHC area or the district. Such active search should supplement and not substitute the surveillance system. The data should not be extrapolated or used for estimating rates.

4. PROBLEMS ENCOUNTERED IN DATA COLLECTION

4.1 Not All Hospitals Submit Data Regularly or In Time

Polio eradication and neonatal tetanus are **NATIONAL GOALS** which require a team effort. Clinicians have an important role to play in achieving these goals by submitting relevant data in time. Prompt and appropriate action taken by the district health office will reduce incidence (ultimately reach nil incidence), thereby reducing the case load in the hospitals and other health facilities. It is therefore not only the responsibility of the clinicians but also in their interest to report cases.

Senior physicians also have a major role in confirming diagnosis of doubtful cases. Differential diagnosis becomes very important as the incidence declines and there is a high priority to differentiate cases which are clinically similar but due to other causes.

The cooperation of the clinicians will be more forthcoming if their roles and responsibilities are clearly explained and if they know that the data provided is being used effectively.

4.2 Not All Cases Are Seen in the Hospitals

Not all cases seek medical treatment. The proportion of cases seeking such care varies widely with different diseases. There are two main diametrically opposite reasons why all cases are not seen in the hospitals:

- In some diseases, such as diarrhoea and measles, a large proportion of the cases have a mild clinical course and recover spontaneously with home remedies. Many cases with mild to moderate severity are treated by local private practitioners.

- In some diseases, such as neonatal tetanus and pneumonia in young children or obstetric emergencies, case fatality rates are high and the period between onset of symptoms and death is relatively short. Many die before they can seek medical care.

Since the surveillance data should be as complete as possible, other sources of data besides the hospitals should be tapped for information. However, in districts where coverage with the programme interventions is unsatisfactory, the first priority should be to improve coverage levels. It is known for example, that all children are susceptible to measles, unless immunized and therefore all efforts should be directed to increasing coverage levels with measles vaccine in children between 9 to 12 months of age.

4.3 Some cases are seen by more than one hospital/health facility and the same case may be reported more than once (duplication)

Duplication in reported cases can be checked by maintaining line lists of cases. Since poliomyelitis leads to lifelong physical handicap, parents often seek second opinion and visit different hospitals. The child can also be reported by a paediatrician (when seen in the acute phase) and by a physio-therapist (seen in the stage of residual paralysis). The likelihood of duplication further increases when the reporting of cases is made mandatory. The case will be reported, for example, by a private practitioner (who referred the case to a hospital) as well as the hospital (to which the case was referred).

4.4 Criteria of Diagnosis is Not Uniform

Standard case definitions should be widely circulated. The health personnel should be adequately trained and their work supervised. During the monthly meetings with the health personnel, surveillance data should be reviewed and those submitting regular and complete data should be commended.

As the incidence declines and the number of cases become rare, it may become necessary to support clinical diagnosis with laboratory support such as virus isolation from suspect cases of poliomyelitis. A second opinion should also be taken.

4.5 Incomplete Information

Hospitals may not record all the information needed. For example, they may not be recording the date of onset of paralysis for suspect cases of poliomyelitis, which is vital for deciding whether or not to initiate outbreak containment measures and to collect stool samples. Other hospitals may not be recording immunization status.

Where such problems exist, hospitals should be visited personally and the need for such information explained. During the last few years, majority of the hospitals have been very cooperative and have been submitting line lists of poliomyelitis, neonatal tetanus and often all other vaccine preventable diseases regularly in the required format.

5. MANDATORY REPORTING

Complete and timely reports on poliomyelitis and neonatal tetanus are **ESSENTIAL** to achieve the goals of polio eradication and neonatal tetanus elimination. Even a single missed case of poliomyelitis can contaminate the environment and lead to an outbreak in an area considered to be polio free. Although there is no similar risk of an outbreak of neonatal tetanus, by taking corrective measures more cases can be prevented.

Reporting of cases of poliomyelitis and neonatal tetanus should be made **MANDATORY** in all states and districts. Non-reporting of a case should be taken as a dereliction of duty and departmental action should be initiated against the concerned medical or para-medical personnel. Medical superintendents of all hospitals should be advised of the mandatory reporting of cases of poliomyelitis and neonatal tetanus.

Immediate reporting of a sudden increase in cases should also be made **MANDATORY** so that action is taken for investigation of a possible outbreak, prevention of the spread of the outbreak to other vulnerable pockets and for treatment of cases to prevent deaths.

III. DATA ANALYSIS

1. MONTHLY ANALYSIS OF DATA

Regular and timely analysis is as important as regular and timely collection of data. The very purpose of collecting data is defeated if data are not analyzed properly and used effectively. The effectiveness of the follow-up action depends on the promptness with which it is undertaken, especially in the event of an outbreak.

1.1 Completeness of Reporting

The analysis of the data should include assessment of the quality of information. The data should be checked for regularity and completeness. A simple way of doing this is to maintain a monthly record of data received from the reporting sites.

Reporting Site	J	F	M	A	M	J	J	A	S	O	N	D
Hospital A	3/2	7/3	16/5	8/5	14/6	9/7	6/8	11/9	12/10	10/11	12/12	7/1
Hospital B		13/3			6/6	5/7		10/9			13/12	
...												
CHC A		9/3	4/4	8/5	7/6			8/10	9/11	5/12	4/1	5/2
CHC B	14/2	8/3		15/5	8/6	9/7		14/9		13/11		8/1
...												
PHC A	6/2	6/3	11/4	10/5	5/6	6/7	7/8	10/9	15/10	9/11	6/12	7/1
PHC B			9/5	9/5		20/9	20/9	20/9		27/12	27/12	8/3
PHC C	4/2	6/3	5/4	4/5	3/6	4/7	7/8	6/9	4/10	5/11	4/12	4/1
...												
Total	4	6	5	6	6	6	4	7	4	6	6	6

This record will show if all the reports have been received or not. A single missing report from a large hospital during the month when the seasonal incidence is highest can lead to a false declining trend. All reporting units must be asked to submit a 'nil' report if no cases are seen to rule out low incidence due to incomplete reports. The example, given above, shows incomplete reporting in the district.

1.2 Are there Discrepancies in Reported Data?

The reports should be checked to see if there appear any discrepancies

in reported data. For example, a 'nil' report from a hospital which has during the previous months submitted large number of cases or a large number of cases from a PHC which had earlier reported few cases. Such reports should be reconfirmed.

1.3 Increase in the Reported Number of Cases

The reported number of cases should be compared with the number of cases reported during the previous month as well as the corresponding period of the previous year. If there is an increase in the total number of cases check to see if there is a general increase from most reporting units or a substantial increase by one or two reporting sites.

If the increase in the number of cases is localized, verify the reported number to rule out human error of reporting or mis-diagnosis of cases. Take appropriate action if there is an outbreak.

An example of the records in District A is shown below.

Reporting Site	Jan	Feb	Mar	Cum 1994	Jan	Feb	Mar	Cum 1993
Hospital A	12	14	10	36	13	16	12	41
Hospital B	5	8	2	15	4	6	3	13
CHC A	0	1	0	1	0	0	2	2
CHC B	1	0		1	0	10	0	10
PHC A	0	5		5		0	0	0
PHC B			0	0	0		1	1
PHC C			15	15	0	0	0	0
Total	18	28	27	73	17	33	18	68

1.4 Decrease in the Reported Number of Cases

The reported number of cases should be compared with the number of cases reported during the previous month as well as the corresponding period of the previous year. If there is a decline in the total number of cases check to see if all reporting units have submitted data. Remind the defaulting centres.

If all units have reported, check if the decline commensurates with the control measures taken. For example, the number of cases of severe dehydration seen in the hospitals will fall if home available fluids are started early and

children receive ORS solution at the sub-centres to prevent overt dehydration. Similarly, effective mop-up rounds conducted in the high risk pockets will flatten the seasonal peak and sharply reduce the incidence of poliomyelitis.

A decrease in cases which does not commensurate with improvements in the programme interventions may be due to the cyclic pattern of the disease or fallacies in reporting.

1.5 Estimate Degree of Under-Reporting of Cases

- On an average, 15% of the pregnancies are likely to have serious complications requiring medical care, including 5% where caesarean section may be necessary. At average national maternal mortality ratio of 4 maternal deaths per 1000 deliveries (or one death for every 250 deliveries), around 200 to 250 maternal deaths are expected in a district with a population of around 20 lakhs and about 50,000 to 60,000 deliveries annually. Deaths following illegal abortions are included in maternal deaths. Since the proportion of domiciliary deliveries by untrained personnel is high, many women die at home without medical care and are unreported. Besides collecting information from the hospitals, peripheral health staff should also be alerted to report maternal deaths.

- In a district with 50,000 to 60,000 live births every year and an IMR of 79 per 1000 live births, an estimated 4000 to 4750 children will die before reaching the age of one year. Around 28% of the deaths are presumed to be due to pneumonia.

ESTIMATION OF PNEUMONIA DEATHS IN INFANTS AT DISTRICT LEVEL

❖ Population of the district	=	20,00,000
❖ CBR	=	29.2/1000 population
❖ Number of live births	=	58400
❖ IMR	=	79/1000 live births
❖ Number of infant deaths	=	4614
❖ Deaths due to pneumonia	=	1292

The number of pneumonia cases are 6 to 20 times the number of deaths depending on the case fatality rates. The number of cases and deaths will be proportionately more when children one to five years are included. The rates are high in districts where early identification and treatment of pneumonia has not been successfully operationalized and where surveillance and health care services are unsatisfactory. Essential newborn care to prevent hypothermia and infections and immunization against measles are other important interventions to reduce morbidity and mortality rates due to pneumonia.

Under-reporting leads to a **FALSE SENSE OF SECURITY.** Under-reporting of cases is also an indication of poor utilization of MCH services.

Thus if the number of pneumonia cases are grossly under-reported, many children are probably dying due to lack of medical care. Similarly if the proportion of institutional deliveries is low, many women are delivering under conditions with a high risk of death of both the mother and the child.

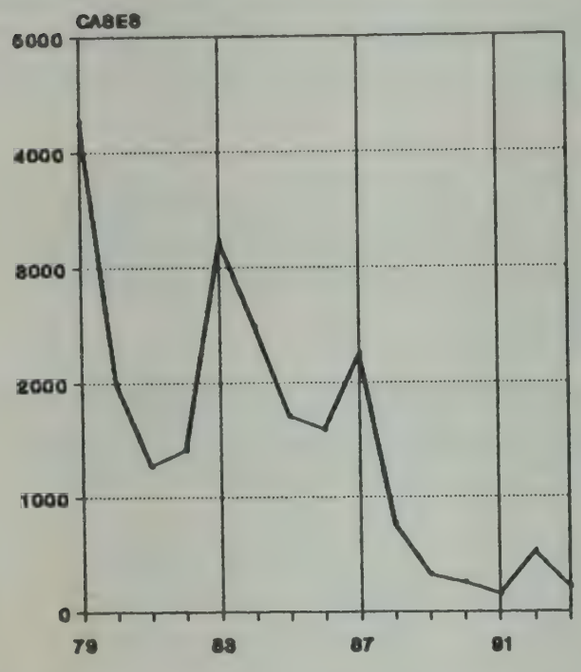
If there is gross under-reporting of cases it will be difficult to document impact of services on disease incidence.

2. ANNUAL ANALYSIS OF DATA

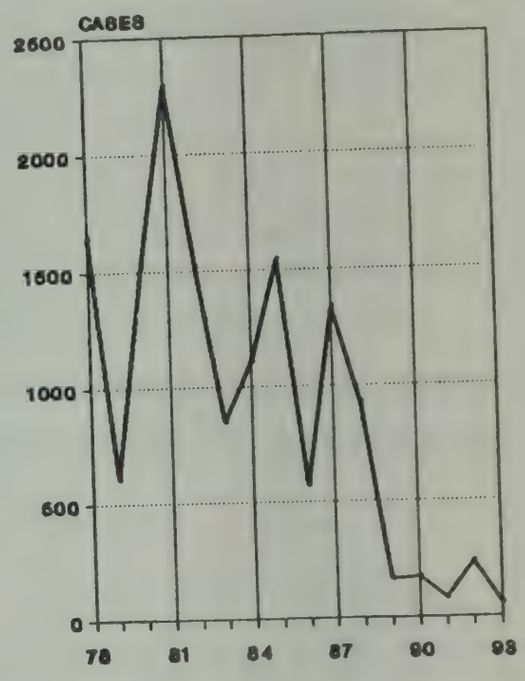
2.1 Trends in Disease Incidence

The annual number of cases are compared with the number of cases of previous years. Improvement in programme interventions should reflect in declining trends of disease incidence and number of hospitalized cases. The declining trends of poliomyelitis in Karnataka and Punjab are given below as examples.

POLIOMYELITIS: KARNATAKA

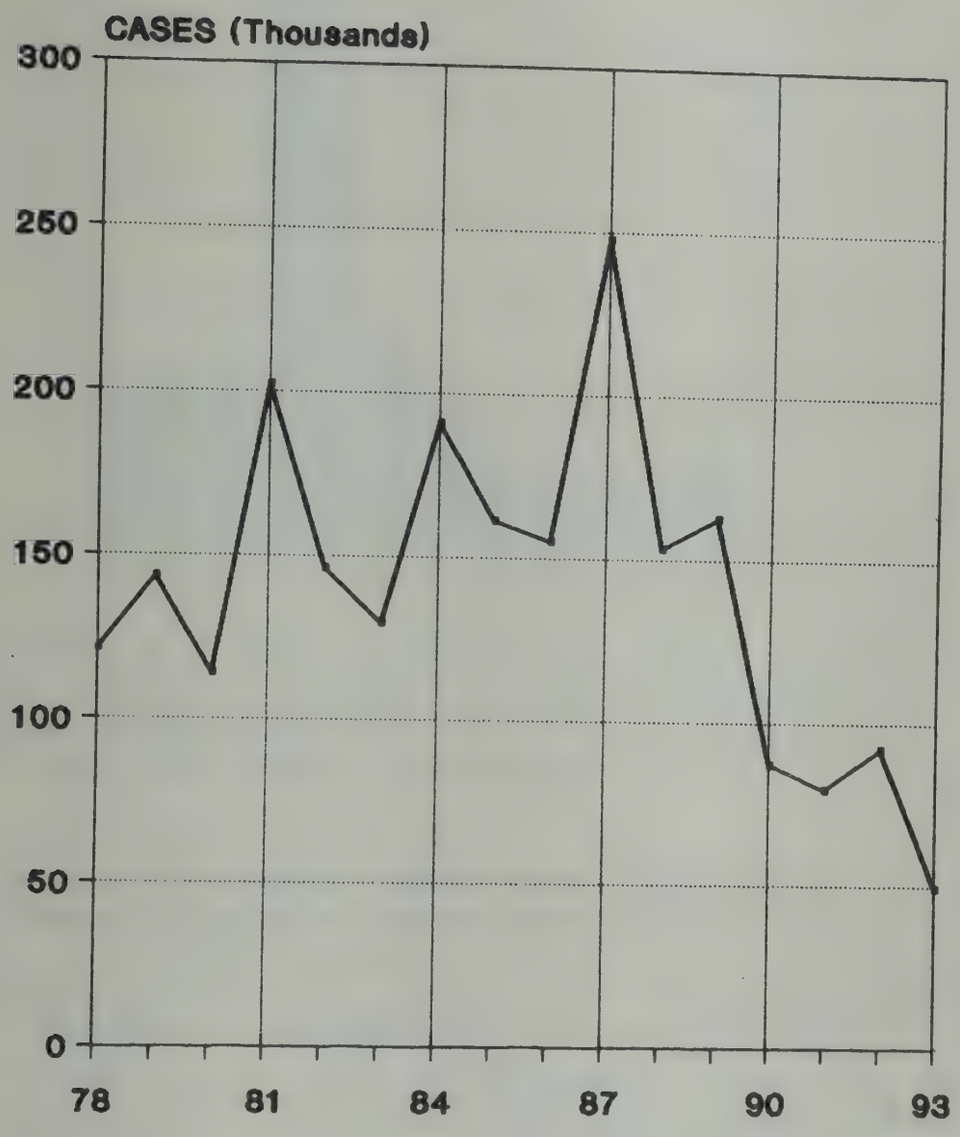


POLIOMYELITIS: PUNJAB



2.2 Cyclic Pattern of the Disease

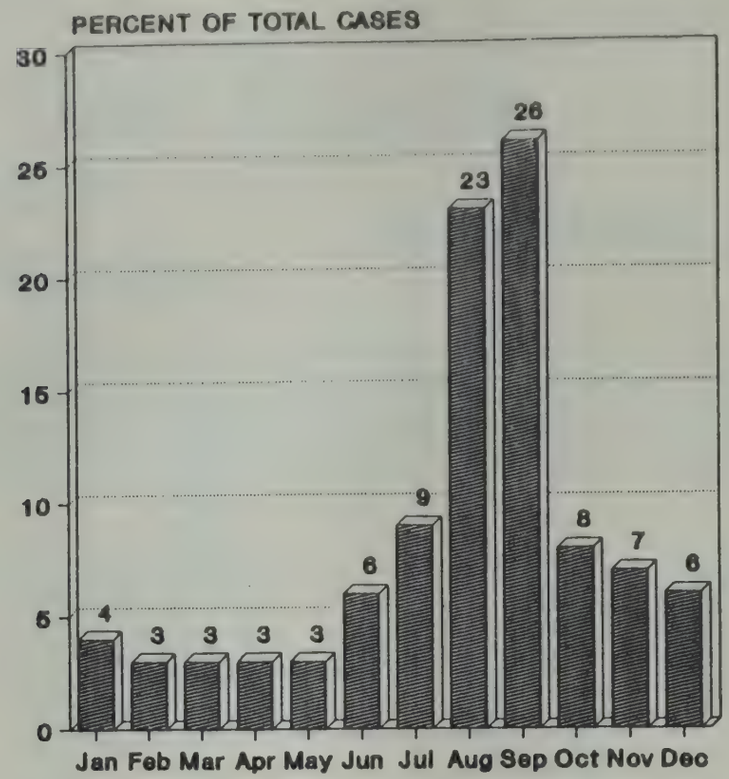
Prior to the immunization programme a cyclic pattern in the incidence of vaccine preventable diseases was recorded. For example, an increase in the incidence of poliomyelitis and measles was reported every two to four years. The period between the peaks will, however, increase and the intensity of the peaks decline with increasing immunization coverage levels. If the cyclic pattern of the disease in the area are known, an increase in the incidence can be anticipated and precautionary measures can be taken in the high risk pockets. If the recorded data do not show any change in the cyclic pattern despite high sustained immunization coverage levels, the quality of the immunization programme and the reported immunization coverage levels should be checked. The cyclic pattern of measles at the national level is shown as an example.



2.3 Seasonal Pattern of Diseases

Many diseases have a typical seasonal pattern. In endemic areas, cases of poliomyelitis increase during the period May to September, with the maximum cases being reported in July-August. Similarly, nearly half the cases of neonatal tetanus in endemic districts occur in the months of August and September. Recording the seasonal pattern is important for programme interventions and for monitoring impact.

NEONATAL TETANUS
SEASONAL INCIDENCE



- If a seasonal pattern is recorded, the disease is endemic. If high immunization coverage levels are reported such areas, these should be verified. Cases should be spot-mapped to identify pockets of low coverage (if over-all immunization coverage levels were found to be high).

- Control measures taken prior to the seasonal increase can flatten the peak and significantly reduce the annual number of cases. Thus if action is taken to protect all births with estimated date of delivery in August and September by TT immunization and providing the women with DDK and with information on clean deliveries so that they can ensure these practices by whoever assists them during delivery, number of cases of neonatal tetanus will drastically fall. Similarly mop-up rounds with OPV conducted prior to the seasonal increase in cases will have a significant epidemiological impact.

- Essential supplies, such as ORS packets, can be distributed in time, especially in the vulnerable pockets.

- IEC activities can be programmed according to needs.

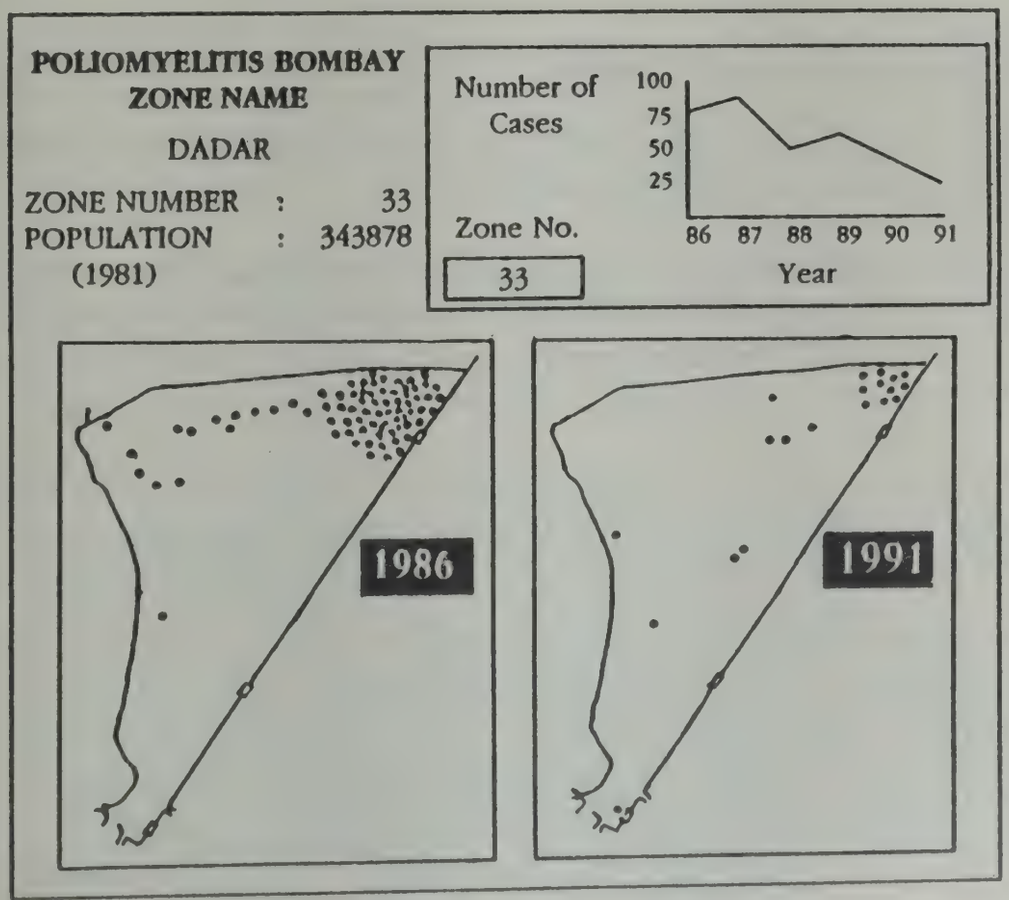
- If no cases are reported or can be detected through active search in high risk pockets during the during the 'seasonal peak' period, it is very likely that there are few or no cases. Thus, if in a hospital which was previously recording a large number of cases, no cases of neonatal tetanus are seen during the months of August and September, or poliomyelitis in July and August, it is a positive indicator of impact of programme interventions.

2.4 Spot-Map Cases by Residential Address

If line lists of cases are received, these can be used for spot-mapping areas from where cases have been recorded. A 'dot' is put for each case in the village (or urban ward) of residence. If any area consistently reports cases, status of the services in the area should be checked and additional measures taken, if necessary.

Spot mapping of cases by residential status is important as often cases can come to a hospital from large distances. Cases may be from neighbouring districts or even neighbouring states. Cases with residence in the concerned district may be clustered in selected PHC areas. If all cases are recorded by district in which the hospital is located, the analysis of the data will be skewed and will not be useful in monitoring the impact of the services in the district concerned or for initiating follow-up activities.

While spot-mapping cases, it should be kept in mind that there may be more 'high-risk' areas than reflected by the reported number of cases. Cases from inaccessible areas with poor communication facilities may not come for treatment. In places where health infrastructure and IEC activities are inadequate, community awareness and health seeking behaviour may be less satisfactory than in other areas. Other parameters should also be used, therefore, in addition to surveillance data for identifying 'high-risk' pockets in each PHC area and in the district as a whole. All areas with long-term staff vacancy, difficult to approach villages with poor communication facilities, peri-urban areas with inadequate health facilities, crowded localities with poor sanitary conditions such as urban slums and areas with recorded low coverage levels should also be considered as high risk.



Spot maps help to identify:

- Pockets from where cases are consistently reported
- Pockets from where cases are expected but not reported

2.5 Determine the Sex Ratio of Reported Cases

Line lists can be used to document the sex ratio of cases. If there is a large differential, IEC efforts must be stepped up in the area to promote equal treatment opportunities for children of both sexes.

2.6 Analyze Immunization Status

The immunization status of all cases should be recorded, irrespective of diagnosis. A high proportion of unimmunized cases seen in the hospitals is a reflection of low immunization coverage levels in the community.

The immunization status of cases of vaccine preventable diseases should be analyzed separately. As immunization coverage levels increase, the proportion of cases with history of immunization will also increase but the total number of cases will fall. A rapid check of vaccine efficacy can be made using the methodology given in chapter VII of the manual. If the vaccine efficacy is less than expected, the reasons should be checked with the highest priority. These include over-estimation of immunization coverage levels, vaccination at the wrong age and unsatisfactory quality of the cold chain. The diagnosis of the cases should also be confirmed and second opinion taken if necessary.

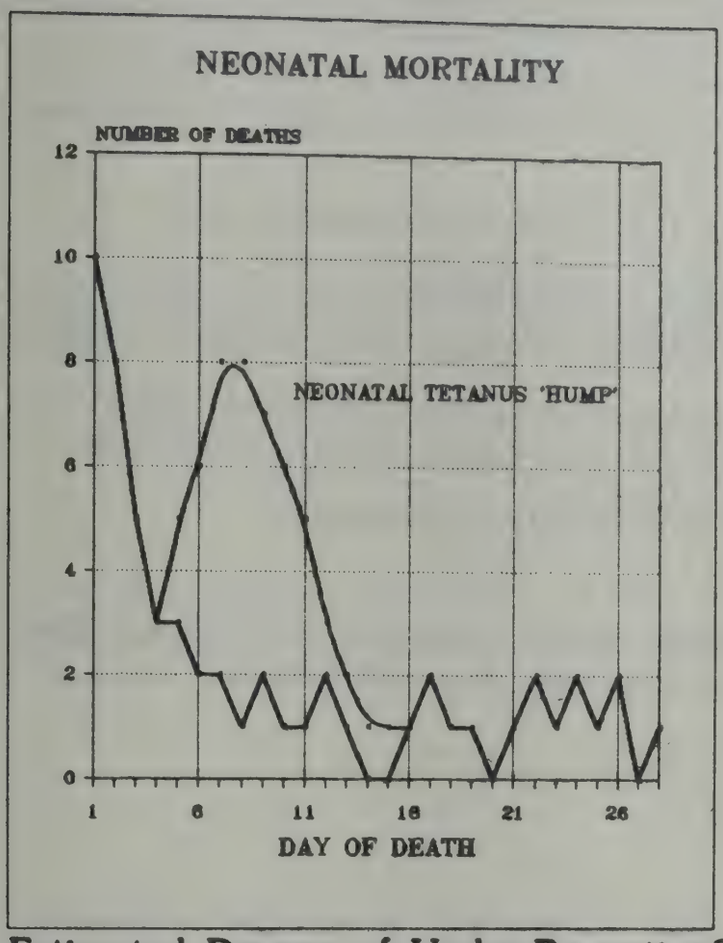
2.7 Analyze Age-Groups Affected

Analysis of the age-groups affected is important to prioritise action for preventive measures and IEC activities.

- At the national level, for example, the median age for poliomyelitis is 18 months and for measles 24 months (that is, half the total cases occur before 18 months and 24 months of age, respectively) highlighting the urgency for the early completion of the immunization schedule.

- More than half the cases of diarrhoea admitted in the hospitals are less than one year of age. Exclusive breastfeeding and proper weaning are thus important interventions for preventing cases of diarrhoea.

- Analysis of neonatal deaths by age in days is a monitoring tool for assessment of neonatal tetanus elimination. In areas where neonatal tetanus is a problem, a 'hump' will be seen between the 5th and the 14th day if a graph on neonatal deaths by day of death is plotted. This hump disappears with the elimination of neonatal tetanus and majority of the deaths will be recorded in the first week after birth.



2.8 What is the Estimated Degree of Under-Reporting?

Rough estimates of the expected number of cases and deaths should be made. These should be compared with the total numbers actually recorded. For some diseases and conditions, you should aim at 100% reporting. This should include all maternal, neonatal and infant deaths (especially in the rural areas) and all cases of poliomyelitis and neonatal tetanus. Increase in reporting of pneumonia and diarrhoea cases will confirm that utilization of services is improving and that more children are having access to appropriate management practices.

3. DIFFERENTIAL DIAGNOSIS

- As immunization coverage levels increase and the number of cases of vaccine preventable diseases decline more stringent clinical criteria may be required to confirm diagnosis to exclude cases which are clinically similar to the vaccine preventable diseases. The immunization programme can lose credibility because of the perceived poor impact of the services if mis-diagnosed cases continue to be reported. **In case of doubt, a second opinion should be taken**. In one hospital, for example, more than 75% of the cases with the provisional diagnosis of diphtheria were found to be non-diphtheria.

4. IMPROVEMENT IN THE SURVEILLANCE SYSTEM

An increase in the reported number of cases or deaths is not always a negative sign or reflection of inadequate programme interventions. An increase in the reported incidence which occurs as a result of action taken to improve the surveillance system is a **POSITIVE SIGN**. In the first few years the number of reported cases are expected to increase. This increase will be due to:

- Increase in the number of reporting sites
- Improvement in the completeness of reporting
- Active surveillance through the paramedical personnel
- Increased awareness in the community about the danger signs and improvement in the health seeking behaviour
- Increased accessibility to treatment

You should be able to distinguish between a genuine increase in cases and reported increase due to improved surveillance. Since this can only be done at the level at which the data are collected, analysis of data at all levels is important.

EXERCISE A

1. How would you assess the quality of the surveillance system in your area?

2. List three major strengths and three major weaknesses of the surveillance system in your area.

3. List five steps you will take to improve the surveillance system.

4. What additional surveillance data you would need to improve the effectiveness of programme interventions in your area?

5. Have you used the surveillance data in the past to improve the effectiveness of programme interventions in your area. Describe.

6. Based on the data currently available with you, can you document impact of the services? Describe.

EXERCISE B

The population of your district is 13.6 lakhs. The crude birth rate in your state in 1992 was 32.0 and the IMR was 75.

114 cases and 4 deaths due to pneumonia were reported last year.

1. If 28% of the infant deaths are presumed to be due to pneumonia and case fatality rate is 10%, how many cases and deaths due to pneumonia would you expect in one year.

2. You have completed the CSSM training programme of the paramedical personnel in all the PHCs areas in the district. The reported number of cases and deaths this year are similar to the numbers reported last year. List three possible reasons for no change in the reported figures, although you expected a substantial increase.

3. What steps would you take to check the validity of the reasons mentioned above. What steps would you take to correct them?

EXERCISE C

As part of your strategies to reduce infant and child mortality rates, you have trained the paramedical personnel for the prevention of diarrhoea-associated dehydration by early use of home available fluids and ORS.

According to the surveillance data, 2400 cases of diarrhoea were treated in the district hospital last year. 800 children were admitted and 650 received IV fluids. The surveillance data for this year shows no change in the hospital admissions or treatment practices.

1. List three possible reasons why the surveillance data does not reflect any impact of the measures taken by you to reduce cases of severe dehydration in children.

2. How would you check the validity of the reasons listed above?

3. What corrective measures would you take?

IV. POLIO ERADICATION AND NEONATAL TETANUS ELIMINATION

The principles of surveillance for poliomyelitis and neonatal tetanus are similar to that for other diseases. However, the requirements in terms of completeness and timeliness of reporting and of the follow-up action to be taken are more stringent in view of the goals of elimination and eradication. Even a single case should trigger immediate follow-up action to identify problems and to initiate corrective measures.

1. POLIO ERADICATION

1.1 Goal

The goal of polio eradication means that:

- There are no clinical cases of poliomyelitis.
- The circulation of the wild polio viruses are eliminated from the environment.

1.2 Completeness of Reporting

- The surveillance system should be such that **NO CASE OF POLIO IS MISSED**. For every clinical case of poliomyelitis, there are at least 100 or more children who may have no clinical symptoms but who excrete polio viruses.
- The peripheral health staff must be asked be asked to report any suspect cases of poliomyelitis in their areas.
- Reporting of all cases of acute flaccid paralysis (AFP), including causes other than poliomyelitis in children under 15 years should be started. In an average district of 1.5 to 2 million population 3 to 5 cases of AFP of non-polio etiology are expected annually (1 case per 100,000 children under 15 years of age).
- Reporting of cases should be made **MANDATORY**. A **NIL** report should be sent monthly if no cases are seen.

1.3 Timeliness of Reports

- Notification of a polio case must be immediate. Polio viruses can spread very rapidly. Preventive measures have little epidemiological impact unless taken within 15 days of onset of paralysis. Stool samples collected within 15 days of onset of paralysis have a higher virus isolation rate.

1.4 Line Lists

- Notification of the case should include relevant information about personal history, clinical findings, including date of onset of paralysis, immunization status and full address for tracing the child at home.

- Line lists should be maintained for all reported cases of poliomyelitis at the subcentre, PHC and district levels. The information should include name, name of the father or mother, age (in months), sex, date of onset of paralysis, date of examination, immunization status (number of OPV doses received), date of the last dose of OPV, site of paralysis and COMPLETE ADDRESS. If laboratory tests have been conducted, the results should be noted. The clinical status at 60 days follow-up (and subsequent visits, if required) should be recorded.

1.5 Special Attention to High Risk Areas

- The transmission of wild polio viruses can continue in areas of high population density and poor sanitary conditions, such as the urban slums. Pockets of low immunization coverage and poorly accessible areas are other high risk areas. Since surveillance may also be poor in these areas, cases may not be detected in time unless special efforts are made.

1.6 Prepare Spot-Maps

- Reported cases should be spot mapped by areas of residence.

- Mop-up rounds should be conducted in the low transmission season in areas from which cases have been reported.

- Mop-up rounds should also be conducted in areas identified at 1.5 above.

1.7 Confirmation of Diagnosis

- Cases of poliomyelitis have residual polio paralysis 60 days or more after onset of paralysis. If the child has fully recovered and there is no muscular atrophy or neurological deficit, the cause of acute paralysis is likely to be of non-polio etiology. In some cases repeat visits may be required if recovery is not complete but paralysis is not typical of polio. Residual paralysis following poliomyelitis is proximal and asymmetrical. Unilateral foot drop is seen in traumatic neuritis. Bilateral foot drop can occur following GBS but children usually recover fully.

- Stool examination of the case and close contacts (under 5 years of age) for isolation of wild polio viruses. Stool samples should be

collected as soon as possible after onset of paralysis in closed containers (the procedure is similar to the collection of stool samples for other purposes) Test tubes with transportation medium and sterile tubes for anal tubing to collect samples from cases seen in the OPDs are also available from the concerned laboratories through the State MCH Officers. The sample should be sent to the testing laboratory immediately as a sample which has dried will not be suitable for testing. The sample should be kept in the cold chain during transportation and storage. Vaccine carriers used for carrying vaccines should **NOT** be mixed with carriers used for stool samples. The sample should be collected BEFORE initiating outbreak containment measures. Polio virus isolation are carried out at 5 regional centres at NICD, Delhi; Enterovirus Research Centre, Bombay; King Institute of Preventive Medicine and Public Health, Madras; Central Research Institute, Kasauli and Pasteur Institute of India, Coonoor.

- If the child dies before confirmation of diagnosis, the case should be listed as probable poliomyelitis and all action undertaken as though the case was poliomyelitis. If information of the case was received within 15 days of onset of paralysis, stool samples from close contacts may be taken for virus isolation (this is important for areas that are polio-free). Investigations should also be conducted to find out if there are any other cases in the area or if the index case can be linked epidemiologically to another confirmed case of poliomyelitis.

1.7 Differential Diagnosis

- The other common causes of acute flaccid paralysis (AFP) in children are Guillain Barre Syndrome (GBS), transverse myelitis (TM) and traumatic paralysis due to sciatic nerve injury. Cases of acute flaccid paralysis should be examined by a senior physician. In case of doubt, a second opinion should be taken. Poliomyelitis excluded as a cause of paralysis in all cases of AFP so that **NO CASE OF POLIOMYELITIS IS MISSED**.

- A table of the main clinical features of the above causes of AFP is given in the Annexure.

1.8 Follow up Action on Reported Cases

- If a case is reported within 15 days of onset of paralysis, outbreak containment measures should be taken in the area of residence of the case. The area covered should be as large as possible such as the entire subcentre area or the urban slum. Two doses of OPV should be given to all children under three years, irrespective of immunization status, at an interval of one month.

- Such outbreak containment measures are not recommended as a routine in endemic areas and during the seasonal peak as these are likely to have little epidemiological impact. In such areas, the first

- Priority is to increase immunization coverage levels and to conduct mop-up rounds in the high risks pockets in the low transmission season.

- Active search for more cases through key informers in the village or urban slum should be made. If a single case of AFP has been reported, detection of another case will help to confirm diagnosis (epidemiological link).

- Assess status of immunization services in the area of residence and take corrective action to improve coverage and quality of services.

- Follow-up case after 60 days for confirmation of diagnosis.

In a district with a population of about 10 lakhs, with approximately 37% of the population under 15 years of age, 3 to 4 cases of acute flaccid paralysis of non-polio etiology can be expected annually.

2. NEONATAL TETANUS ELIMINATION

2.1 Goal

- The goal of neonatal tetanus elimination is defined as a rate of less than one case per 10,000 live births (less than 1 case per 1000 live births per block). However, since TT immunization is very effective and clean delivery practices substantially reduce risks of neonatal tetanus, all PHCs and districts are expected to aim at zero cases of neonatal tetanus.

2.2 Completeness of Reporting

- The surveillance system should be such that **NO CASE OF NNT IS MISSED.**

- The peripheral health staff must be asked be asked to report any suspect cases of neonatal tetanus in their areas.

- Reporting of all deaths within 28 days of birth (neonatal) should be started. Majority of the deaths due to neonatal tetanus are between 5 and 14 days and deaths during this period can be investigated to rule out tetanus as a cause of death.

- Reporting of neonatal tetanus should be made **MANDATORY**. A **NIL** report should be sent monthly if no cases are seen.

2.3 Timeliness of Reports

- Notification of a neonatal tetanus case must be immediate. A case of neonatal tetanus is a failure of the system to provide TT immunization, ensure clean delivery practices and disseminate relevant information to the family and the community so that clean delivery practices are adopted by them. Immediate measures can prevent further deaths.

2.4 Line Lists

- Line list should be maintained for all reported cases. The information should include name (if given), name of the father or mother, age (in days), sex, date of onset of symptoms, date of examination, immunization status (number of TT doses received by the mother), date of the last dose of TT (prior to delivery), where and by whom the delivery was conducted, outcome (date of death if child died) and COMPLETE ADDRESS. The line listing is necessary to check for duplications, age (days after birth), month of illness (seasonality), sex, immunization status, delivery practices and identification of high risk pockets by mapping reported cases.

2.5 Special Attention to High Risk Areas

- Neonatal tetanus occurs in areas with poor sanitary conditions, high proportion of domiciliary deliveries by untrained personnel and low immunization coverage levels. Special attention to collection of information from these areas should be made and the data from the high risk pockets analyzed separately. Since surveillance may also be poor in these areas, cases may not be detected unless special efforts are made.

2.6 Prepare Spot-Maps

- Reported cases should be spot mapped by areas of residence.
- Additional efforts should be made in these areas including supply of DDKs, training of dais, IEC activities to promote clean delivery practices and special immunization efforts to increase TT immunization coverage
- Similar action should be taken in areas identified at 1.5 above.

2.7 Sex Analysis

- In most states there is a wide gap in the number of male and female children brought for treatment. This is due to social rather than

biological factors. The total number of cases should be taken as TWO TIMES the reported cases in males.

2.8 Analysis of Monthly Incidence

- In endemic areas, more than half the cases occur in the period July to September. Surveillance reports for these months must be checked to ensure that there is no missing report.

2.9 Classify District/PHC by Status of Neonatal Tetanus Control

NEONATAL TETANUS ELIMINATION
CLASSIFICATION OF DISTRICT/PHC

NNT HIGH RISK

- ❖ RATE > 1/1000 LIVE BIRTHS

OR ❖ TT2 COVERAGE < 70%
OR ❖ ATTENDED DELIVERIES < 50%

NNT CONTROL

- ❖ RATE < 1/1000 LIVE BIRTHS

AND ❖ TT2 COVERAGE > 70%
AND ❖ ATTENDED DELIVERIES > 50%

NNT ELIMINATION

- ❖ RATE < 0.1/1000 LIVE BIRTHS

AND ❖ TT2 COVERAGE > 90%
AND ❖ ATTENDED DELIVERIES > 75%

EXERCISE D

1. The death of an 8 day old child was reported by the ANM. What information will you need to decide if this is a case of neonatal tetanus. Give at least 3 measures that could have prevented the death in the child, presuming that this was due to tetanus.

2. List 5 steps you will take prevent similar deaths from occurring.

3. 3 neonatal tetanus deaths were reported from your PHC area last year. How will you confirm that more deaths did not take place?

V. OUTBREAK INVESTIGATIONS

1. OBJECTIVE OF OUTBREAK INVESTIGATIONS

The primary purpose of outbreak investigations are to:

- Reduce case fatality rates by early and appropriate treatment
- Prevent spread of the outbreak to other vulnerable pockets.
- Assess how prevention strategies could be further strengthened to reduce the risk of such outbreaks in the future.

2. WHAT IS AN OUTBREAK

- An outbreak or an epidemic is defined as an occurrence in a community of cases of an illness clearly in excess of expected numbers. The number of cases which are needed to be called an outbreak varies according to the status of the programme for the control of the disease. Even a single case of a disease can constitute an outbreak if it is from an area which had no case in the previous 12 months or more. A case of vaccine preventable disease from an area with reported coverage levels of 85% or above merits immediate investigations. A single case of poliomyelitis and neonatal tetanus should trigger immediate investigations and follow-up action. [Tetanus is not transmitted person to person and technically there are no outbreaks but investigations and follow-up action must be initiated in view of the goal of neonatal tetanus elimination].
- **Even a single case from far-flung, difficult to approach villages, tribal areas and pockets where utilization of health services is poor or health infrastructure inadequate, should trigger investigations.**
- For purposes of notification by the peripheral health staff a cluster of cases or a death following measles or diarrhoea in a subcentre area should be immediately reported.
- Reported increase in the incidence due to improved surveillance is not an outbreak. The first principle of outbreak investigations is to confirm diagnosis of as many reported cases as possible. Much time and efforts may be wasted due to misdiagnosis.

3. OUTBREAK INVESTIGATIONS

In investigating an outbreak it is necessary to develop a detailed description in terms of time, place and person.

Cases by time : The onset of the illness of cases should be graphed by days or weeks, as appropriate. This type of graph is commonly referred to as the epidemic curve.

It is also useful to present previous year's information or possibly an average of several previous years for comparison on a line graph. Such graphs help to demonstrate the magnitude of the outbreak compared to the previous reported incidence, how rapidly the disease is spreading and if the control efforts are succeeding.

Cases by place : A map of the area or even a rough sketch can be drawn showing where each reported case resides to indicate geographical distribution of cases.

Cases tend to cluster and it may also be useful to mark affected schools or other institutions on the map in addition to residential locations. Such mapping may assist in identifying the sources of infection.

Cases by person : Cases should be described in terms of age, sex, vaccination history and other relevant data. It is usually sufficient to group cases by age-groups like 0-11 months, 12-23 months, 24 to 59 months, 5-9 years, 10-14 years and 15 years and above. Sex differentiation is also helpful.

The immunization status of each case (for outbreaks of VPDs) must be carefully investigated to ascertain the number of doses of vaccine received by the patient. Immunization cards or immunization registers should be checked to verify the immunization status. Verbal history should be used if such records are not available. The quality of the immunization programme in the area should be assessed and the cold chain system reviewed.

4. CONTROL MEASURES

- For most of the vaccine preventable diseases, including measles, immunization of the susceptible is the first priority. However, unless the information of the outbreak has been very prompt, immunization of close contacts and other children living in the immediate neighbourhood is unlikely to have a significant epidemiological impact in controlling the magnitude of the outbreak since the children would have already been exposed to infection. **The immunization efforts should, therefore, be directed in other similar high risk pockets (in the same district as well as neighbouring districts) to which the outbreak can potentially spread.**

- Timely and appropriate management of cases of diarrhoea and pneumonia (which are the common post-measles complications), will reduce case fatality rates and save many lives. It is also important that community is made aware of the importance of increased fluid intake and continued feeding during episodes of diarrhoea and of the signs of pneumonia

(increased respiratory rate and chest indrawing) for seeking immediate medical help.

- Vitamin A deficiency increases case fatality rates and is particularly marked following measles. Assessment of vitamin A coverage in the area and administration of vitamin A, if coverage levels are low, should be a part of all investigations of outbreaks in children. Following an outbreak of measles, children should be examined for signs of vitamin A deficiency and the health staff should be alerted to identify and report cases of night blindness.

- Health educational activities for the early identification and appropriate management of cases of diarrhoea and pneumonia should also be started in other similar high risk pockets (in the same district as well as neighbouring districts) to which the outbreak can potentially spread.

- Medical officers of other PHCs in the district and district officers of neighbouring districts should be intimated about the outbreak so that necessary precautionary measures can be started by them such as stepping up immunization of children in vulnerable pockets, vitamin A administration and health educational and motivational efforts for immediate reporting of cases should there be an outbreak and appropriate management of cases to prevent deaths. Precautionary measures would also include inventory control to ensure adequate supplies of vaccines and drugs, including ORS packets.

- It is obvious that precautionary measures taken in anticipation of outbreaks in high risk pockets will be more effective in minimizing morbidity and mortality rates. Similarly, health educational activities which are started before an outbreak has occurred are likely to be more effective since more time is available for planning and for mobilization of resources.

5. CONCLUSIONS AND RECOMMENDATIONS

All outbreak investigations should include an assessment of the main reasons why the outbreak occurred. This is necessary to necessary to list activities and recommend an action plan to minimize the recurrence of outbreaks in the future and to prevent deaths, should an outbreak occur.

EXERCISE E

An inquiry was conducted by the primary health centre medical officer following an increase in the reported cases of measles as compared to the previous month. Comparison with the corresponding period last year also showed an increase in cases. The results of the inquiry were as follows:

- The patient register was checked to make sure that all cases were recorded accurately and no problems were found.
- A review of immunization records showed that fewer children had received measles immunization every month for the past six months.
- The register showed that some of the children who had received measles vaccine were less than 9 months of age at the time of vaccination, including a 7-month-old child who was given measles vaccine along with the third dose of DPT. The health worker said that she gave the vaccine to improve immunization coverage levels as children may not return at the age of 9 months.
- Immunization coverage levels in children under one year of age according to the records of the ANM was 56%. 12% of cases reported had history of measles immunization.

1. What were the likely reasons for the outbreak ?

2. What follow-up action you would take ?

VI. SEVERE ADVERSE EVENTS FOLLOWING IMMUNIZATION

1. INTRODUCTION

The vaccines used under the Immunization Programme are safe and effective. This is documented by the decade of experience of using more 650 million doses of these vaccines annually in the country and similar experience worldwide. However, as there is no vaccine which is 100% effective, there is also no vaccine which is entirely without risk. The severe, life-threatening adverse events following immunization are, however, extremely rare. The benefits of immunization far out-weigh any risks even in areas where the incidence of vaccine preventable diseases has reached negligible levels.

The surveillance of severe adverse events is, however, important as they can influence public acceptance of immunization services. Events that are coincidental to immunization are often wrongly attributed to immunization. Some neurological syndromes can occur spontaneously in infants or be due to causes unrelated to immunization. It is possible to rule out immunization as a cause of death or severe reaction only through proper and immediate investigations of the event.

Although vaccines are safe if the guidelines are followed, severe reactions can occur if these are improperly handled and administered. Surveillance of adverse events is necessary to identify such programmatic errors so that corrective measures are taken to prevent similar reactions and deaths in the future.

2. REPORTING AND INVESTIGATION OF SEVERE ADVERSE EVENTS

The surveillance of severe adverse events following immunization was started in 1986. Each state has constituted expert teams for the investigation of such events. Reported deaths following immunization are required to be investigated within 48 hours. All reported deaths and other severe events requiring hospitalization are to be notified immediately to the State MCH Officer and to the Ministry of Health and Family Welfare. Copies of the investigation and action taken reports are also submitted for compilation of reports at national level and dissemination of information to the other programme officers.

The basic principles of field investigations of outbreaks can be used for investigation of adverse events. All children immunized during the particular session should be followed up and relevant details entered in the line list of cases with adverse reactions. It is important that children not immunized of the same age-group in the locality are also examined to rule out coincidence.

An analysis of data should be made, by time, place and person in the same manner as in any epidemiological investigation. The details of the children immunized, with reactions and number of deaths should be line listed.

Operational aspects of the programme need to be carefully reviewed with special reference to procedures followed for the collection, storage and issue of vaccines; methods adopted for sterilization of syringes and needles (including the total quantities of syringes and needles available for a session) and frequency and quality of routine field monitoring.

Where the adverse events are unexpected and not easily explainable, it is important that the signs and symptoms of each case are carefully noted. The **timeliness** and **completeness** of investigations is of prime importance. Check for use of reconstituted vaccine of BCG/Measles being transferred from session to session and used beyond the recommended hours.

Open vaccine vial should be sent to the laboratory for testing for sterility, if contamination of the vial is suspected. The concerned batch number and date of manufacture should be intimated immediately to the manufacturer under intimation to the State and Central Programme Officers. Six vials of the concerned batch should be sent under cold chain for testing if instructed by the State or Centre. Reaction due to manufacturing defects do not occur as isolated cases.

A report should be prepared giving details on the investigations conducted. This report should start with general information regarding the place where the event occurred. The name of the state, district and PHC/ward should be clearly stated. The following points should be covered in such a report:

- **Cases**
  - ☐ How and when were the first symptoms observed and who reported the event?
  - ☐ Who conducted the investigations and when were they begun?
  - ☐ How were the investigations conducted?
  - ☐ Number of children immunized and the type of reactions observed. The line list and summary tables should be attached to the report.
  - ☐ Whether any children of the same age-group in the area, who were not immunized, had similar symptoms.

- **Clinical Aspects**
  - ☐ Detailed clinical picture
  - ☐ Treatment given
  - ☐ Outcome
  - ☐ Diagnosis by clinicians and observations, if any made by them.

- **Operational Aspects**

  - ☐ How are immunization services generally provided in the area? Procedure followed on the day of the event?
  - ☐ When and from where the vaccines were received? How were the vaccines stored and transported?
  - ☐ How many syringes and needles are available and procedures followed for sterilization of the equipment?
  - ☐ Who administered the vaccines and what was the training they received?
  - ☐ Have similar reactions been observed in the past and were they reported?

- **Laboratory Investigations**

  - ☐ Samples sent for testing and the names of laboratories. The testing of the vaccine can take 2-4 months depending on the vaccine and the tests.

- **Suggestions and Recommendations**

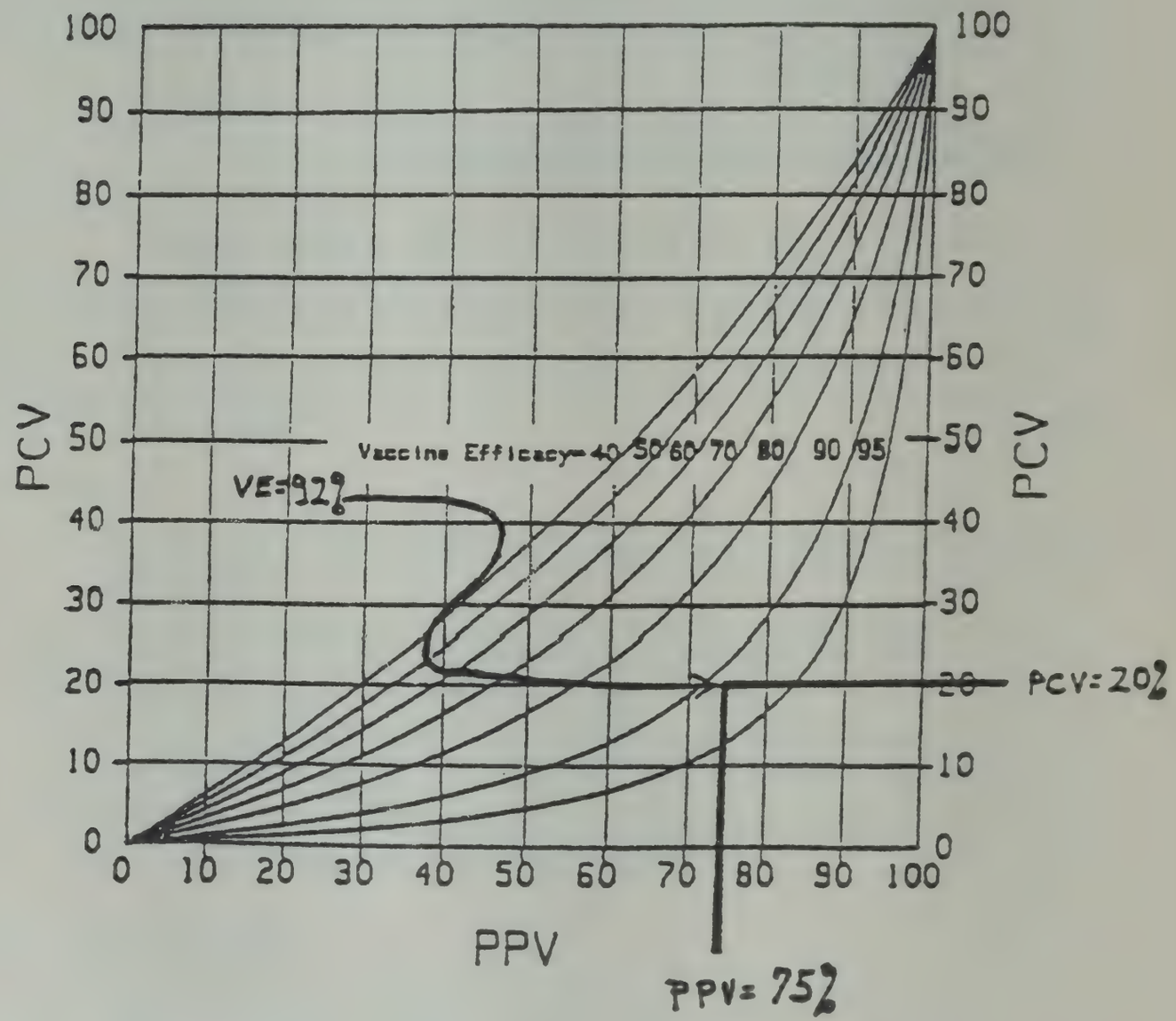
  - ☐ What was the likely cause of the adverse event?
  - ☐ Measures recommended to minimize risks in future.

Date: **Name and designation**

VII. ESTIMATION OF VACCINE EFFICACY

The term vaccine efficacy refers to the ability of the vaccine to prevent disease effectively. The vaccine efficacy is influenced by the age at immunization, potency of the vaccine at the time of administration (quality of the cold chain) and overall immunization coverage levels. A rapid assessment of vaccine efficacy can be done, if immunization coverage levels and proportion of cases with history of immunization are known, by using the graph given below.

Percentage of cases vaccinated (PCV) per percentage of population vaccinated (PPV), for seven values of vaccine efficacy (VE)



The vaccine efficacy can also be calculated by using the formula given below:

$$VE = \frac{(PPV)^*(PCU) - (PPU)^*(PCV)}{(PPV)^*(PCU)}$$

For vaccines for which only one dose is required, the formula can be further simplified.

$$VE = \frac{PPV\text{-}PCV}{PPV - (PPV)^*(PCV)}$$

where :

VE = vaccine efficacy
PCU = proportion of cases unvaccinated
PPU = proportion of population unvaccinated
PCV = proportion of cases vaccinated (full course)
PPV = proportion of population vaccinated (full course)

For example:

An outbreak of measles has occurred in a district. The measles immunization coverage in children 12 to 23 months of age, as determined by vaccination coverage survey, was 75%.Of the resident cases of measles in the age-group 12 to 23 months, 20% had history of immunization.

$$VE = \frac{0.75 - 0.20}{0.75 - (0.75 \times 0.20)} = \frac{0.55}{0.75 - 0.15} = \frac{0.55}{0.60} = 0.92 \text{ or } 92\%$$

VIII. MATERNAL MORTALITY

1. Maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration or site of pregnancy from any cause related to or aggravated by pregnancy or its management but not from accidental causes.

2. Maternal mortality rate is defined as the number of maternal deaths per 100,000 women in the reproductive age-group (15-44 years). Maternal mortality ratio is the number of maternal deaths per 100,000 (or per 1000) deliveries.

3. For every maternal death, many women experience serious, life-threatening complications often leading to chronic and debilitating sequelae.

4. For every maternal death it is estimated that there are 14 perinatal deaths (28 weeks gestation to first 7 day after birth).

5. It is estimated that around 15% of the pregnancies will require medical care and that in 5% caesarean section may be necessary.

6. Information on maternal deaths should be obtained from the hospitals and the health centres. Line lists should be maintained and surveillance data used to take appropriate follow-up action to prevent similar deaths in the future. The data can also be used for assessing the effectiveness of programme interventions.

   The line lists should include the following information:

   Name
   Husband's name
   Complete address
   Age of deceased
   Parity
   TT immunization status
   Intake of IFA tablets
   Referred by
   Place of delivery
   Date of delivery
   Person attending delivery
   Place of death
   Date of death
   Cause of death
   Condition of newborn at birth

Maternal deaths should be reviewed to assess the quality of the safe motherhood programme (whether the women received appropriate antenatal care, was the maternal complication identified and treated, was the obstetric emergency recognized and referral made in time). If referrals were made by a peripheral health facility, check to see if the woman reached the FRU. Since the risk of death is very high without appropriate medical care, a woman who was referred but did not reach an FRU or the district hospital should be counted as a maternal death for purposes of estimating maternal mortality ratio or rate.

All hospitals providing emergency obstetric care (EOC) are expected to provide data in the following format annually.

Hospital ..... District .....

Year 19.....

Total maternity admissions
Total maternity admissions with complications
Total deliveries
Total caesarean sections
Total maternal deaths
List causes of the maternal deaths*

No. of obstetric cases given blood transfusion
No. of referred abortion cases with complications
No. of MTPs

Total maternity cases referred to other institutions
(including cases seen in the OPD)
Outcome of the these cases
If any maternal death, cause of the death*

* Attach line list.

Most hospitals providing obstetric emergency care maintain records of maternal deaths. Obtain the information in the format given below for the last three years, which can be used as baseline.

In addition to the information from the hospitals and the health centres, the health workers (female) should be asked to report maternal deaths. She can provide the relevant information (line list), including the probable cause of death.

Review of surveillance data and assessment of current status of maternal care services will help you take problem-specific and area-specific follow-up action to improve such care.

CASE DEFINITION OF VACCINE PREVENTABLE DISEASES

Classification	Suspect	Physician confirmed	Laboratory confirmed
Personnel	Lay Public/MPWs	Medical Officers	Medical Officers
Methods	History	History + Clinical Investigations	Laboratory Identification
Neonatal tetanus	Normal suck or cry for first 2 days Onset between 3-28 days Inability to suck Stiffness or convulsions	Trismus Generalised muscle rigidity Convulsions	None
Tetanus	Injury or ear infections Difficulty in opening mouth Stiffness or convulsions	Trismus Generalised muscle rigidity Convulsions	None
Poliomyelitis	Fever Abrupt onset of weakness or paralysis of the leg(s) or arm(s) No progression of paralysis after first three days Paralysis not present at birth or associated with serious injury or mental retardation	Flaccid paralysis No sensory loss Muscle tenderness Absent or depressed deep tendon reflexes Asymmetrical findings Wasting of affected muscles (late findings) Residual paralysis 60 days after onset of illness should be added as a criteria in areas of low incidence	Positive virus culture for polio virus Positive serology (4-fold or greater rise in serum polio antibody titre)
Measles	Generalized blotchy rash lasting 3 or more days Fever Cough, running nose or red eyes Exposure to a suspect case of measles in the previous 2 weeks or an epidemic of measles in the area	Generalised maculopapular rash Fever 38'C. (101 'F) or more Cough, coryza, conjunctivitis or Koplik's spots	Positive serology (4 fold or greater rise in serum antibody titre)
Whooping cough (pertussis)	Cough persisting 2 weeks or more Fits of coughing which may be followed by vomiting Typical 'whoop' in older infants and children Exposure to a suspect case in previous 2 weeks or epidemic of whooping cough in the area	Prolonged coughing followed by apnoea cyanosis or vomiting Typical 'whoop' in older infants and children Subconjunctival haemorrhages	White blood cell count with 15,000 lymphocytes/cu mm or more (supportive of diagnosis but non-specific) Positive culture or immunofluorescence of nasopharyngeal secretions for Bordetella pertussis bacteria.

Diphtheria	Sore throat (with or without difficulty in swallowing) Mild fever Greyish-white membrane in throat (with or without difficulty in breathing) Exposure to a suspect case of diphtheria in the previous 1 week or epidemic of diphtheria in the area	Greyish-white membrane in throat (with or without difficulty in breathing) Acute pharyngitis, naso-pharyngitis or laryngitis Airway obstruction Myocarditis or neuritis (paralysis) one to six weeks after onset of symptoms	Common alternative diagnosis excluded by appropriate tests: negative throat culture for group A streptococci, negative blood test for mononucleosis Positivé culture of Corynebacterium diptheriae (demonstration of toxin production recommended but not
Tuberculosis (childhood)	Listlessness Loss of weight Prolonged low grade fever Tuberculosis in family or close neighbours	BRAIN - Dazed condition, stiffness of neck, convulsions, severe headache, fever GLANDS - Lymphadenopathy in neck and axilla which may suppurate LUNGS - Fever, cough, weakness, poor appetite BONES - Fever, pain, swelling and crippling of joints And any one of the following : Positive reaction on tuberculin testing (>10 mm induration) Favourable response to anti-TB therapy	Microscopy or culture of tubercle bacilli, identified as mycobacterium tuberculosis from secretions or tissues Suggestive radiological appearances on films of chest, bones or joints Suggestive histological findings in biopsy material

Note: Children may come for post measles/ pertussis infection

A history of possible antecedent measles or pertussis in the last six weeks should be taken for all children with pneumonia or diarrhoea (for measles)

Record immunization status of all cases

Investigate all suspect cases of neonatal tetanus and poliomyelitis within two days to confirm diagnosis

ANNUAL INCIDENCE RATE OF POLIOMYELITIS [1]

PER 1000 CHILDREN 0 TO 4 YEARS (Based on sample surveys 1981-1982)

State/UT	Incidence Rate per 1000 children	
	Rural	Urban
Andhra Pradesh	1.7	1.4
Gujarat	2.5	2.2
Haryana, Punjab	3.1	1.7
Chandigarh	—	—
Karnataka, Gao	1.2	1.2
Madhya Pradesh (Bhopal & Jabalpur Division)	1.9	1.7
Maharashtra	1.4	1.3
Orissa	0.8	0.7
Rajasthan (Jaipur Division)	3.1	2.5
Tamil Nadu & Pondicherry	1.9	2.1
Uttar Pradesh (Allahabad Division)	2.3	1.6
West Bengal	0.8	1.0
Delhi	—	1.6
ALL INDIA	1.7	1.6

[1]. This survey was carried out when the EPI Programme was still in its infancy. Therefore, it is presumed that the above incidence rates for poliomyelitis will be true if immunization coverage in a population were near - zero.

ANNUAL NEONATAL TETANUS MORTALITY RATE [2]

PER 1000 CHILDREN 0 TO 4 YEARS (Based on sample surveys 1981-1982)

State/UT	Incidence Rate per 1000 children	
	Rural	Urban
Andhra Pradesh	6.8	2.7
Bihar	11.3	5.3
Gujarat and D & N Haveli	5.8	1.9
Haryana, Punjab	—	—
Chandigarh	8.4	3.1
Karnataka, Gao	5.1	1.6
Kerala	2.0	1.9
Madhya Pradesh (Bhopal & Jabalpur Division)	20.4	1.4
Maharashtra	4.1	4.9
Orissa	8.6	2.0
Rajasthan (Jaipur Division)	13.5	3.4
Tamil Nadu & Pondicherry	4.9	—
Uttar Pradesh (Allahabad Division)	66.7	15.3
West Bengal	11.9	0.5
Delhi	—	1.0
ALL INDIA	13.3	3.2

[2] This survey was carried out when the EPI Programme was still in its infancy. Therefore, it is presumed that the above incidence rates for poliomyelitis will be true if immunization coverage in a population were near - zero.

DIFFERENTIAL DIAGNOSIS OF POLIOMYELITIS

Signs & Symptoms	Polio	GBS*	TM**	TN***
AFP Instalation	24-48 Hours	Hrs. 10 days	Hrs-4 days	Hrs-4 days
Fever	High. Always present at onset of FP, disappears next day	Rarely present	Rarely present	Often present before, during and after FP
Flaccid Paralysis (FP)	Acute Asymmetrical. Mainly proximal	Acute Symmetrical Distal	Acute Lower limbs Symmetrical	Acute Asymmetrical Only one limb
Tone	Decreased or absent in affected limb	Global hypotonia	Hypotonia of lower limbs	Decreased or absent in affected limb
Deep Tendon Reflexes	Decreased to absent	Globally absent	Absent lower limbs	Decreased to absent
Sensation	Severe myalgia	Cramps, tingling hypo/anaesthesia palms & soles	Anaesthesia of lower limbs with a sensory level	Pain in gluteus Hypothermia
Cranial Nerves	Only in Bulbar form	Often present	Not present	Not Present
Respiratory Insufficiency	Only in Bulbar form	In severe cases secondary to bacterial pneumonia	Often thoracic with sensory level	Not Present
CSF	Inflammatory	Albumino-cytologic dissociation	Normal or few cells	Normal
Bladder Dysfunction	Absent	Sometimes transient	Present	Never
Nerve Conduction Velocity: 3rd Week	Abnormal: Ant. Horn cell disease (Normal first 2 weeks)	Abnormal: demyelination	Normal or abnormal. No diagnostic value	Abnormal axonal darange
EMG	Abnormal denervation	Normal	Normal	Normal
Sequele at 3 months	Severe asymmetric atrophy, Skeletal deformities later	Mild, symmetric atrophy of peroneal muscles	Flaccid dysplegia atrophy after years	Moderate atrophy only affected limbs

* GBS Guillain Barre' Syndrome
** TM Transverse myelitis
*** TN Traumatic Neuritis

INVESTIGATION OF NEONATAL DEATHS

To be completed by the Medical Officer on all infants who died within the 1st month of life (a separate form for each neonatal death).

I. GENERAL INFORMATION

1. State/UT .....
2. District .....
3. Town (Mohalla/PHC/Village .....
4. Physician's Name .....
5. Date .....
6. Cluster No. .....

II. BACKGROUND INFORMATION ON NEONATAL DEATH

1. Name of child .....
2. Sex of child .....
3. Father's name .....
4. Head of household .....
5. Date of birth of child .....
6. Address of child .....
7. Name of person interviewed .....
8. Relationship of person interviewed to child .....
9. Date of death of child .....

III. SYMPTOMS PRECEDING INFANT'S DEATH (Please circle appropriate answer)

1. Was the infant able to suck milk after birth?	Yes	No
2. Did the infant stop sucking milk when illness began?	Yes	No
3. Did the infant have fever?	Yes	No
4. Did the infant have convulsions?	Yes	No
5. Was the infant noted to be stiff?	Yes	No

IV. INFANT'S CARE SINCE BIRTH (Please circle appropriate answer)

1. Who delivered the child?
   Doctor/LHV/ANM
   Dai (trained)
   Dai (untrained)
   Non-dai family members
   Other (please specify) .....

2. Where was the child delivered?
   Hospital/Health centre
   Home
   In the fields
   Other (please specify .....

3. When the child became ill, who treated the child?
   Government health centre
   Registered Physician (Allopathic/ Ayurvedic/Homoeopathic)
   Unregistered Physician
   No treatment was received

V. MOTHER'S IMMUNIZATION HISTORY

1. Does the mother know about vaccination with TT? Yes/No (Circle)
2. Number of doses received during this pregnancy .....

VI. OTHER INFORMATION ON MOTHER

	Yes/No (Circle)
1. Is the mother alive?	
2. If dead, date of death	.....
3. Symptoms preceding death	.....

VII. MEDICAL OFFICER'S DIAGNOSIS

1. Cause of neonatal death .....
2. Cause of mother's death .....

.....
(Signature of the Medical Officer)

CLINICAL OBSERVATIONS OF LAME CHILDREN

To be completed by the Medical Officer on all lame children (a separate form for each lame child)

I. GENERAL INFORMATION

1. State/UT ..... 4. Physician's Name .....
2. District ..... 5. Date .....
3. Town (Mohalla)/PHC (Village) ..... 6. Cluster No. .....

II. BACKGROUND INFORMATION ON LAME CHILD

1. Name of child ..... 5. Date of birth of Child .....
2. Sex ..... 6. Address of Child .....
3. Father's Name ..... 7. Person interviewed .....
4. Head of Household ..... 8. Relationship of person interviewed to child .....

III. HISTORY OF ILLNESS RESULTING IN LAMENESS OF THE CHILD

1. Date of onset of lameness .....
2. Address of child at on set of lameness (Outside the district or not) .....
3. Number of doses of polio vaccine received by child preceding onset of lameness .....
4. Medical care during illness resulting in lameness - (circle correct answer)
   (a) Registered physician (Allopathic/Ayurvedic/Homoeopathic)
   (b) Health Centre.
   (c) Un-registered physician
   (d) Other (please specify)
   (e) No treatment received

5. Did the child have fever at the time of onset ? Yes No
6. Was the onset of the lameness acute ? Yes No
7. Did the lameness progress (increase) after onset ? Yes No

IV. PHYSICAL EXAMINATION OF CHILD (Circle correct answer)

1. Paralysis of lower limb present — Yes No
2. Affected Limb — Right Left Both
3. Type of Paralysis present — Flaccid/Spastic/No Paralysis
4. Sensation in affected limbs — Normal Impaired
5. Muscle atrophy (wasting) in affected limb — Yes No
6. Gait — Normal/Impaired/ requires assistance/unable to evaluate

V. EVALUATION OF LAMENESS (circle appropriate answer)

1. Lameness not present
2. Lameness present
   (a) does not require mechanical aid to walk.
   (b) requires mechanical aid to walk.
   (c) unable to walk.

VI. PHYSICIAN'S DIAGNOSIS ON CAUSE OF LAMENESS (circle appropriate answer)

1. Poliomyelitis
2. Trauma (please specify) .....
3. Congenital deformity (please specify) .....
4. Other (please specify) .....

.....
Medical Officer's Signature

NATIONAL CHILD SURVIVAL AND SAFE MOTHERHOOD PROGRAMME
MONTHLY P.H.C. REPORT

P.H.C._____ MONTH_____ 199_____

Yearly Target : Infants_____ District_____

Number of Sessions : a) Planned_____ Pregnant Women _____

b) Actually Held _____

A. ANTE-NATAL CARE

CASES		For the Month	Cumulative since April
Registered			
Institutional Deliveries			
Complicated Cases referred			
Domicilliary deliveries conducted by	HW (F) / LHV		
	Trained Dais		
	Others		
Condition of newborn at birth	Weight below 2,000gms		
	Weight 2,000-2,500gms		
	Weight 2,500gms and above		
	Weight not taken		
	Still born		
Abortion			

B. IMMUNISATION, IFA AND VIT. A.

			For the Month				Cumulative since April			
PREG-NANT WOMEN	Tetanus Toxoid (TT)	Dose								
		1.								
		2.								
		b.								
	IFA TABLETS		Initiated		Completed		Initiated		Completed	
	(Prophylactic)									
	(Therapeutic)									
CHILDREN			Under 1 Yr		Over 1 Yr		Under 1 Yr		Over 1 Yr	
			Male	Female	Male	Female	Male	Female	Male	Female
	BCG									
	OPV	1.								
		2.								
		3.								
	DPT	1.								
		2.								
		3.								
	MEASLES									
	VITAMIN A	1.								
	OPV BOOSTER									
	DPT BOOSTER									
	VITAMIN A	2.								
		3.								
		4.								
		5.								
	DT (5 Year)	1.								
		2.								
	TT (10 Years)	1.								
		2.								
	TT (16 Years)	1.								
		2								

C. SURVEILLANCE

Disease		Number Reported			
		For the Month		Cumulative Since April	
		Cases	Deaths	Cases	Deaths
Diphtheria					
Pertussis					
Tetanus Neonatorum					
Tetanus (others)					
Poliomyelitis (Acute)					
Measles					
Under Five Years	Tuberculosis				
	Pneumonia				
	Acute Diarrhoea				
	Dysentry				
Maternal Deaths (Reported)	Before Delivery				
	During Delivery				
	Within 6 weeks of Delivery				

D. VACCINE SUPPLY (IN DOSES)

Vaccine	Opening balance	Received during the month	Consumed during the month	Balance at the end of month
DPT				
OPV				
BCG				
MEASLES				
TT				
DT				

E. STATUS OF COLD CHAIN EQUIPMENT

Equipment/ Make	Machine Number	Whether working	If not, date of breakdown	Date of Intimation	Remarks

* Please mention in this column:

a) If machine is beyond repair and needs replacement.
b) If the machine needs compressor replacement.

F. UNTOWARD REACTIONS

	During the month	Cumulative Since April
1. Reported deaths associated with immunisation		
2. Number of abscessess		
3. Other complications		

Date :_____

To: The District M.C.H. Officer

_____

Signature of Medical Officer

GLOSSARY

Crude Birth Rate (CBR)	$\frac{\text{Number of live births during the year}}{\text{Mid-year Population}}$	X 1000
Crude Death Rate (CDR)	$\frac{\text{Number of deaths during the year}}{\text{Mid-year Population}}$	X 1000
Infant Mortality Rate (IMR)	$\frac{\text{Number of infant deaths during the year}}{\text{Number of live births during the year}}$	X 1000
Still Birth Rate (SBR) (IMR)	$\frac{\text{Number of still births during the year}}{\text{Number of live births + still births during the year}}$	X 1000
Peri-natal mortality Rate (PMR)	$\frac{\text{Number of still births + infant deaths of less than 7 days during the year}}{\text{Number of live births + still births during the year}}$	X 1000
Neo-natal mortality Rate (NMR)	$\frac{\text{Number of infant deaths of less than 28 days during the year}}{\text{Number of live births during the year}}$	X 1000
Post Neo-natal Mortality Rate (PNMR)	$\frac{\text{Number of infant deaths of over 28 days during the year}}{\text{Number of live births during the year}}$	X 1000
Age-specific Mortality Rate (ASMR)	$\frac{\text{Number of deaths in a particular age-group}}{\text{Mid-year population of the same age-group}}$	X 1000